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Mineralogy of sandstones and localization of oil matter in productive horizons of high-viscosity oil in permian deposits of the volga-ural region (Russia)

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Abstract

© SGEM2017. All Rights Reserved. Bitumen deposits in Permian sediments in the Volga-Ural region are interesting as sources of unconventional oil. The reservoir rocks in the bituminous deposits are sand and sandstone of varying degrees of strength. For the prognosis of productive areas, it is important to study the peculiarities of the composition of bitumen-containing rocks and the mechanisms of localization of oil matter in them. These processes are closely related to the conditions of formation of the surrounding rocks. We examined samples of bituminous rocks of the Sheshminsky horizon of the Ufimian (Kungurian – ICS) stage. Petrographic studies were carried out using a polarization microscope and methods of scanning electron microscopy and computed tomography. Bitumen-saturated rocks are represented by sands and sandstones, mostly small- and medium-grained, polymictic, from dark gray to light gray with a greenish tinge, and in saturated intervals - from brown to black color. Sands and sandstones are often cross-bedded, with inclusions of pyrite crystals. Quartz is predominant in the mineral composition of sand and sandstone, albite, calcite, chlorite and pyrite are less common. In all sandstones there are also numerous fragments of igneous rocks and minerals. The clastic material is not sufficiently sorted, which indicates the short duration of its transfer. The angularity of the fragments contributes to the increase of the intergranular space and, as a consequence, to the high reservoir properties of the rocks. The investigated samples are characterized by a high degree of reservoir properties. The void-pore space in the rocks of oil- and bitumen-saturated sediments is represented by a system of communicated pores. There is a regularity in increasing the frequency of pores occurrence as a function of the decrease in their size. The oil substance in the studied samples is classified as heavy oil, which makes it difficult to extract. The presence of vanadium in bituminous matter is its characteristic feature. An important parameter characterizing the permeability of sedimentary rocks is the nature and composition of the cement. The presence of carbonate cement, which is forming at the stage of diagenesis and filling the pore space of rocks, negatively affects to reservoir and permeable properties. Clay cement (or its complete absence) increases bitumen saturation of sands. It has been established that the capacity for hydrocarbons is to a greater extent served by pore space, and to a lesser degree - by fractures in the rocks.

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Keywords

Bitumen, High-viscosity oil, Mineralogy, Permian, Sandstones

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